



## DEMONSTRATION PROJECT OVERVIEW

### DC POWERING ARCHITECTURE FOR DATA CENTERS: HIGH VOLTAGE DC POWERING AT THE EQUIPMENT RACK LEVEL

**What it is:** Joint industry & California Energy Commission sponsored demonstration  
**When:** April 2006 to September 2006  
**Where:** Sun Microsystems, Newark, CA  
**More info:** Scheduled open house and "virtual" open house May – July 2006 see <http://hightech.lbl.gov/>

#### BACKGROUND

An alternative approach to conventional AC power uses a DC power distribution scheme throughout a data center. Most data center server racks are not currently powered this way, but with the advent of servers on the market that can operate with either AC or DC, it is possible to use the DC powering approach, thus eliminating extra power conversion steps and losses. Other benefits include reduced cooling needs, higher equipment densities, and reduced heat-related failures.

#### DEMONSTRATION GOAL AND OBJECTIVES

A stakeholder group has been formed by industry and the CEC to investigate:

1. Whether or not DC powered server(s) and/or server racks can provide the same level of functionality and computing performance when compared to similarly configured and operating servers (and/or server racks) containing AC powered server(s), as measured with industry standard measurement devices and software tools.
2. Document any efficiency gains from the elimination of multiple conversion steps in the delivery of DC power.
3. Feasibility for both facility-level as well as rack-level DC conversion and delivery.
4. Identify issues/best practices and make recommendations for implementation.

#### RACK-LEVEL DEMONSTRATION

This demonstration project focuses on DC conversion at the equipment rack level. This approach converts the facility's supplied AC into high-voltage DC via a rack-mounted rectifier unit - the DC voltage under consideration is at 380 VDC, although 48 VDC is also a possibility. This approach concentrates the DC conversion into one unit/location in the rack, removing the AC to DC conversion function from the servers themselves. Figures 1 and 2 contain block and line diagram representation of this option.

Concurrently underway is a demonstration of a facility-level DC architecture – please contact one of the project contacts below to get additional information on these efforts.

Some major advantages of this Rack-Level option include:

- Only one rectifier stage is needed per rack
- Possible efficiency gains from the reduction of on-board AC to DC power supply units in servers
- Allows for better cooling management
- Does not require infrastructure changes for existing data centers

Considerations regarding this approach:

- Suitable only for new server rack configurations
- Does not eliminate all of the possible conversion losses.

#### PROJECT PARTICIPANTS

A listing of project participants is provided below. A complete listing is available from the project contacts.

- |                                    |                                   |                               |
|------------------------------------|-----------------------------------|-------------------------------|
| ▪ Alindeska Electrical Contractors | ▪ Hewlett Packard                 | ▪ RTKL                        |
| ▪ Baldwin Technologies             | ▪ Intel                           | ▪ SatCon Power Systems        |
| ▪ CCG Facility Integration         | ▪ Liebert Corporation             | ▪ Square D/Schneider Electric |
| ▪ Dranetz-BMI                      | ▪ Morrison Hershfield Corporation | ▪ Sun Microsystems            |
| ▪ Dupont Fabros                    | ▪ NTT Facilities                  | ▪ TDI Power                   |
| ▪ EDG2, Inc.                       | ▪ NexTek                          | ▪ Universal Electric Corp.    |
| ▪ EYP Mission Critical             | ▪ Pentadyne                       | ▪ Verizon Wireless            |

#### PROJECT CONTACTS

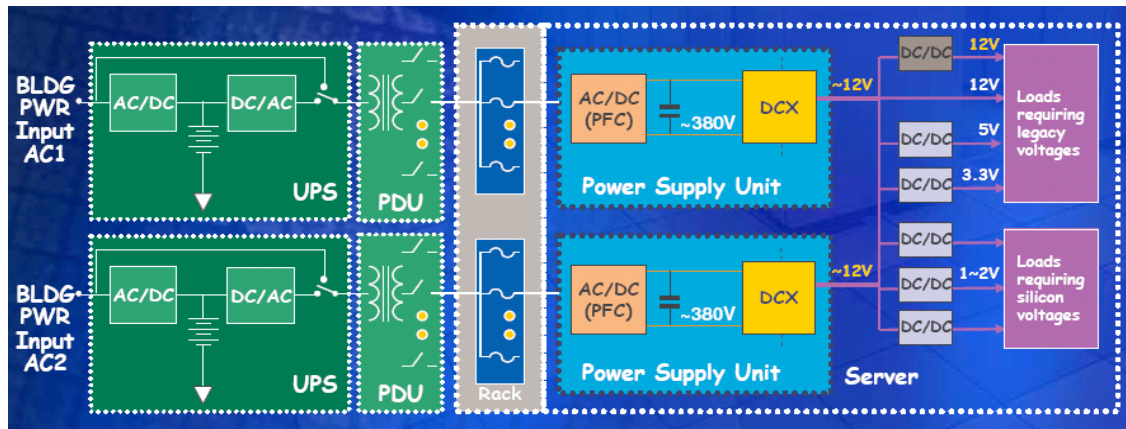
My Ton  
Ecos Consulting  
503.525.2700 ext. 104  
[mton@ecosconsulting.com](mailto:mton@ecosconsulting.com)

Brian Fortenbery  
EPRI Solutions  
865.218.8012  
[bfortenbery@epriolutions.com](mailto:bfortenbery@epriolutions.com)

Bill Tschudi  
Lawrence Berkeley National  
Laboratory  
510.295.2417  
[wftschudi@lbl.gov](mailto:wftschudi@lbl.gov)



**Figure 1. Block Diagram of Proposed Demonstration Set-Up**  
Source: Intel & Sun Microsystems



**Figure 2. Details of Proposed Demonstration Set-Up**  
Source: BTI

